

Note on the Regnal Years in the Elephantine Papyri.

By J. K. Fotheringham, M.A.

(Communicated by E. B. Knobel.)

Mr. Knobel has attempted, in *Monthly Notices*, lxix. pp. 8-11, to discover historically the dates of accession of the Persian kings, and by a comparison of these dates with the regnal years recorded in the Elephantine papyri, to discover the system by which the regnal years were reckoned. He mentions three different systems on which it is supposed that regnal years were reckoned at the period in question (the fifth century B.C.),—(1) from the accession of the king; (2) from the 1st. Nisan following the accession; (3) from the 1st. Thoth preceding the accession. I doubt, however, whether it would be possible to produce tangible evidence of any system in use at that date which did not reckon from the New Year's day following the accession, though the New Year's day may have been different in different countries and in different calendars.

The historical data which Mr. Knobel uses are unfortunately very faulty. He quotes Oppert for evidence that Darius was living in September 485 B.C. But Oppert's dates for the reign of Darius have been shown to be one year too low, and this date should be corrected to September 486 B.C.* He next asserts that Xerxes was assassinated by Artabanus in the beginning of the archonship of Lysitheus, in the 4th. year of the 78th. Olympiad, from which he infers that the assassination of Xerxes was not earlier than July 465 B.C. The date is apparently derived from Diodorus,† who gives the name of the Athenian archon and the Roman consuls, but does not specify the time of year. Diodorus' reputation as a chronologist for the period between the Persian and Peloponnesian wars is unfortunately very low, and in any case we do not know that the authority from whom his date is derived reckoned the year from the entrance of the archon on office. Diodorus, in fact, always identifies the Athenian official year which began in summer with the Roman official year, which appears to have begun at very different seasons at different dates. I do not think any reliance can be placed on this date.

Mr. Knobel is even more unfortunate when he attempts to date the accession of Artaxerxes from Thucydides. According to him, "Thucydides records that in the 4th. year of the 78th. Olympiad, July 465 B.C. to June 464 B.C., Themistocles went up the country,"

* See Professor Weissbach's article, "Über einige neuere Arbeiten zur babylonisch-persischen Chronologie," *Zeitschrift der deutschen morgenländischen Gesellschaft*, Band lv. (1901), pp. 195-220, especially p. 220; also his article, "Zur neubabylonischen und achämenidischen Chronologie," *ibid.*, Band lxii. (1908), pp. 629-647.

† xi. 69.

etc. As it happens, Thucydides * does not assign a date to this event and knows nothing of the reckoning by Olympiads.

Mr. Knobel's next citation is happier. He asserts that "the death of Artaxerxes is recorded by Thucydides as occurring in the winter of the archonship of Stratocles—the 4th. year of the 88th. Olympiad, about December 425 B.C." Here, again, Thucydides † says nothing about archons and Olympiads, but places the event in question in the winter of the 7th. year of the Peloponnesian war, *i.e.* in the winter of 425–4 B.C. This is consistent either with my view that Darius Nothus, who followed after the short reigns of Xerxes II. and Sogdianus, began to reign between Nisan (March or April) and Thoth (December) 424 B.C., or with Mr. Knobel's view that he began to reign in December 424 B.C. Similarly, the treaty between Sparta and Tissaphanes, which is one of the last events mentioned by Thucydides ‡ in his full narrative of the winter 412–411 B.C., and which is dated in the 13th. year of Darius, might well fall within that regnal year, whether we reckon it with Mr. Knobel from December 412 B.C., from a spring New Year in 412 B.C., or from some other date which may have served as New Year's day in Caria or Lydia. Diodorus' date for the death of Artaxerxes and the accession and death of Darius Nothus would suit Mr. Knobel's dates and mine equally well.

Mr. Knobel briefly dismisses the theory that the regnal years are reckoned from 1st. Nisan after the accession by pointing out that in this case the date of Papyrus A, 12th. September 471 B.C., would not fall in the 15th. year of Xerxes, but this conclusion is based upon Oppert's date for the accession of Xerxes, which is, as has been seen, one year too low. There can be no doubt about the identification of the regnal years of Xerxes, because this period is covered by the eighteen years' list which extends into a period when astronomical dates are numerous. The 15th. year, according to the Babylonian reckoning, must have begun in Nisan 471 B.C., although the Babylonian regnal years are reckoned from 1st. Nisan. The earliest dated tablet in the reign of Xerxes belongs to 22nd. Arab-samma in the year of his accession, probably 1st. December 486 B.C. Ptolemy reckons his first year from 1st. Thoth = 23rd. December 486 B.C.

Mr. Knobel goes on to suggest that the years are reckoned from the 1st. Thoth preceding the accession, except where two different regnal years are given in the same papyrus, and here he admits that the lower regnal year is computed from Nisan. To this I should reply, that the papyri afford no evidence which would enable us to determine whether the dates reckoned from Thoth are computed from the Thoth preceding or the Thoth following the accession, though the latter theory is more consistent with the practice of the age. It is also easier to believe that the Jewish dates are reckoned from Nisan, and the Egyptian from Thoth. There are only three instances in the series where the two systems of reckoning would give different regnal years. In two of these

* i. 137.

† iv. 50.

‡ viii. 58.

three (J and K) both regnal years are given. In the remaining instance (B) two regnal years are given, but are not annexed to the different calendar dates, and presumably belong to one system of reckoning. Here we read "The 21st. year (of Xerxes), the beginning of the reign when Artaxerxes the king ascended the throne." Now there is no dispute that the 1st. year of Artaxerxes was the year following the 21st. year of Xerxes; if, therefore, Mr. Knobel were right in supposing that the 1st. year of Artaxerxes was reckoned from the New Year's day preceding his accession, it would follow that his accession would fall in the year after the 21st. of Xerxes, *i.e.* the 22nd. of Xerxes, continuing the enumeration of his years after his death. It is clear, therefore, that this date is not reckoned from a New Year's day preceding the actual accession. If Professor Schürer's identification, which I have accepted, be correct, the date (2nd. January 464 B.C.) falls into the 21st. year of Xerxes reckoned from Nisan, which is also the accession year of Artaxerxes. From this it would follow that the Jewish dates are computed from the New Year's day (in this case 1st. of Nisan) before the king's accession. Mr. Knobel's objection to Professor Schürer's date is, as has been seen, based upon a precarious interpretation of a historian chronologically untrustworthy. The date which he himself suggests (23rd. December 464 B.C.) is inconsistent with his own chronology, according to which the 2nd. year of Artaxerxes, corresponding to the 23rd. of Xerxes, should have begun on the 17th. of December 464 B.C. The date on this papyrus is interesting as being the earliest known date in the reign of Artaxerxes.

Mr. Knobel even goes the length of suggesting that the regnal years in Palestine in the time of Nehemiah were computed from the 1st. of Thoth, on the ground that Chisleu in the 20th. year of Artaxerxes preceded Nisan in the same year. Surely it would be easier to suppose that these years are reckoned, according to the Syrian and modern Jewish practice, from the autumn New Year's day, the 1st. of Tishri.

On the whole, I see no reason for abandoning the opinion that the Jewish dates on the Elephantine papyri are certainly, and the Egyptian probably, reckoned from the New Year's day preceding the actual accession of each king: in the case of the Jewish dates this New Year's day would be the 1st. of Nisan, and in the case of the Egyptian dates the 1st. of Thoth.

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On the Relation between Period and Density of Algol-Variables.

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1. As is well known, a maximum value of the mean density of an Algol-system can be derived from the period (P) and the total duration of eclipse ($2t_0$).^{*} If the orbit is supposed to be circular, this maximum-value D is given by,

$$D = \frac{K}{P^2 \sin^3 nt_0}; \quad n = \frac{2\pi}{P}, \quad (1)$$

where P and t_0 may be expressed in hours, D in the mean density of the Sun as unity.

This value is identical with the *real* mean density (δ) if the two stars are of the same size, and if the inclination of the line of sight to the orbit is zero.

In order to determine the constant K we put—

P = one year = 365.25×24^h ; $nt_0 = 32' 3''.64$ = mean apparent diameter of the Sun; consequently $D = \frac{1}{2}$ and $K = 31.17$.

Thus

$$D = \frac{31.17}{P^2 \sin^3 nt_0} \quad (2)$$

and 31.17 being $= 1.005 \pi^3$, we can bring this into the simple form—

$$D = \frac{P}{(2t_0)^3} \left(\frac{nt_0}{\sin nt_0} \right)^3 \quad (3)$$

Mérianu has shown that D is not very different from δ , if one star is not considerably larger in size than the other.

2. In the *Mitteilungen der Hamburger Sternwarte*, No. 11, Dr. Graff has deduced from his own observations the elements of the orbits of 10 Algol-variables. A slight extension was given to these by Professor Ristenpart (*Ast. Nach.*, No. 4250), who derived from the elements the mean density of the systems by the formula

$$\delta = \frac{a^3 C}{P^2(1 + \kappa^3)} \quad (4)$$

where a is the radius of the relative orbit, κ the radius of the dark satellite, both expressed in the radius of the bright star as unity. If P is given in hours, then $C = \frac{1}{4}K$.

Arranging the stars according to decreasing periods, Ristenpart finds a nearly progressive increase of density; and he adds that this might be expected with regard to formula (4): "Natürlich

^{*} M. Mérianu, "Densité des étoiles variables du type d'Algol," *Comptes Rendus de l'Acad. d. Sciences*, vol. 122 (1896), p. 1254.